TRANSFER GUIDE FOR HIGH-SPEED POWER TRANSMISSION

Technical Field to Which the Invention Pertains

The present invention relates to a transfer guide, which is used for canceling a change in the speed of a power transmission chain, which is meshed with a sprocket to perform a polygonal motion in a power transmitting mechanism, which rotates a camshaft of an internal combustion engine such as a vehicle engine at high speed at a desired timing.

Related Art

As a related art there is a path guide for a high-speed power transmission, disposed in the vicinity of a position where a chain is meshed with a sprocket along a traveling direction of said chain, and including a guide surface, which supports the rollers of the chain in such a manner that the weight of a part of the chain, which advances to said sprocket, is not applied on surfaces of the sprocket teeth as much as possible, and vibration and noise, which is generated in a chain transmission device, which transmits power between sprockets rotated at high speed (see Patent Reference 1 for example).

Patent Reference 1 is Japanese Laid-open Patent Publication No. (Hei) 9-79333 (on page 1, FIG. 1)

Problems to be solved by the Invention

However, a conventional pass guide for high-speed power transmission is designed in such a manner that the centers of the rollers pivot-connected to a roller chain are advanced from a direction of a tangential direction to a meshing pitch circle

formed in the sprocket. Accordingly, when the number of teeth of the sprocket is small, a significant change in the speed of a roller chain is caused by a polygonal motion, which is generated by the rotation of the sprocket.

Further, with high speed rotation of the sprocket, which is rotated at a fixed speed, due to such a significant change in the roller chain speed, intermittent transmission loads, which are produced in the sprocket and the roller chain, are increased, and this intermittent load of the sprocket not only exerts a subtly bad effect on transmission timing for an internal combustion engine such as a vehicle engine through a camshaft, but also is liable to lose durability of a chain power transmission mechanism composed of a roller chain and a sprocket.

There is a further problem that solving the above-mentioned problem requires an excessively large sized and high-strengthened roller chain so that an excessive driving power is spent. Further, there is a problem that power transmission vibration and noise are remarkably increased.

Accordingly, the objects of the present invention are to solve the above-mentioned related art problems and to provide a transfer guide for a high-speed power transmission, which can cancel a change in a transmission chain speed so that smooth transmission timing can be realized and a driving power and vibration noises of the transmission chain can be significantly reduced.

Means for Solving the Problems

The invention of claim 1 solves the above-mentioned problems by that a transfer guide for a high-speed power transmission disposed in a transfer position just before a

transmission chain, which is traveled at a fixed speed by pressing the chain on the inner circumferential side of the chain with a travel limiting guide, is meshed with a sprocket, which is rotated at a fixed speed, and including a curve track to cancel an change in the speed generated in the rollers of said transmission chain, which performs a polygonal motion at a meshing position just after said transmission chain was meshed with said sprocket, characterized in that when three rollers in the transmission chain, which are continued at desired chain pitches, are to be meshed with the sprocket while being opened on an outer circumferential side of the chain from the travel limiting guide, in such an arrangement traveling state that always corresponds to a travel limiting position, a transfer position and a meshing position, said curve track is defined along an movement passage of the roller in said transfer position.

The invention of Claim 2 further solves the above-mentioned problems by that in addition to the configuration of the above-mentioned claim 1, said curve track is formed by continuous two arc-shaped curves.

"The travel limiting position" in the present invention, means a movement region where a transmission roller, which is traveled at a fixed speed, in a manner pressed on an inner circumferential side of the chain with a travel limiting guide including a linear track and a curve track, travels on the travel limiting guide, the transfer position means a movement region where the roller in the transmission chain sent from the travel limiting guide approaches a sprocket to mesh with the sprocket, and the "meshing position" means a movement region of a roller which have just meshed with the sprocket until a subsequent roller meshes with the sprocket.

Action

According to the transfer guide for a high-speed power transmission of the present invention, three rollers in a transmission chain, which are continued at desired chain pitches and are traveled at a fixed speed by being pressed by a travel limiting guide including a linear track or a curve track in an inner circumferential side of the chain, are to be meshed with a sprocket, which is rotated at a fixed speed, while being opened on an outer circumferential side of the chain from the travel limiting guide, in such an arrangement traveling state that always corresponds to a travel limiting position, a transfer position and a meshing position.

Then in the transfer guide for the high-speed power transmission according to the present invention, the curve track is defined along a movement passage of the roller in the transfer position. Accordingly, this curve track meshes with the sprocket during high speed rotation whereby a periodic change in the speed of the transmission chain, which performs polygonal motion is canceled to remove the speed variations of the transmission chain.

The invention will be better understood when reference is made to the BRIEF DESCRIPTION OF THE DRAWINGS, DETAILED DESCRIPTION OF THE INVENTION AND CLAIMS.

BRIEF DESCRIPTION OF THE DRAWINGS

FIG. 1 is an arrangement view of a transfer guide for a high-speed power transmission, which is a first Example of the present invention.

FIG. 2 is a view showing a movement passage for a transmission chain roller.

FIG. 3 is an arrangement view of a transfer guide for a high-speed power transmission, which is a second Example of the present invention.

FIG. 4 is an arrangement view of a transfer guide for a high-speed power transmission, which is a third Example of the present invention.

FIG. 5 is an arrangement view of a transfer guide for a high-speed power transmission, which is a fourth Example of the present invention.

FIG. 6 is an arrangement view of a transfer guide for a high-speed power transmission, which is a fifth Example of the present invention.

A better understanding of the invention will be had when reference is made to the DETAILED DESCRIPTION OF THE INVENTION and CLAIMS which follow hereinbelow.

Embodiments of the Invention

Examples of preferable embodiments of a transfer guide according to the present invention will be described below with reference to drawings. FIG. 1 is an arrangement view of a transfer guide 100 for a high-speed power transmission, which is a first Example of the present invention, FIG. 2 is a view showing a movement passage of rollers in a transfer chain, FIG. 3 is an arrangement view of a transfer guide 200, which is a second Example of the present invention, FIG. 4 is an arrangement view of a transfer guide 300, which is a third Example of the present invention, FIG. 5 is an arrangement view of a transfer guide 400, which is a fourth Example of the present invention, and FIG. 6 is an arrangement view of a transfer guide 500, which is a fifth Example of the present invention.

The transfer guide 100 for the high-speed power transmission, which is the first Example of the present invention, is a transfer guide for canceling a change in the speed of transmission chain called as a timing chain, which rotates a camshaft in an automobile engine at high speed at desired timing and meshes with a sprocket S to perform a polygonal motion, as shown in FIG. 1. The transfer guide 100 for the high-speed power transmission is disposed in a transfer position X2 just before a transmission chain C in which a number of rollers C1, C2, C3, ... were sequentially pivot-connected to each other at given chain pitches Cp and the rollers were traveled at a fixed speed by pressing the chain on the inner circumferential side of the chain with a travel limiting guide R including a linear track, is meshed with a sprocket S, which is rotated at a fixed speed. It is noted that a reference numeral Sα in FIG. 1 denotes a pitch angle per one tooth of the driving sprocket S.

As shown in FIG. 2, when continuous three rollers C1, C2, and C3 in the transmission chain C having a desired chain pitch Cp are to be meshed with the sprocket S while being opened on the outer circumferential side from the travel limiting guide R, in arrangement traveling states, which are always corresponding to the a linear rail R for supporting the conveying surface, the travel limiting position X1, the transfer position X2 and the meshing position X3, a curve track T, which is formed in the transfer guide 100 for the high-speed power transmission of the present invention, is defined as a movement passage consisting of continuous two arc-shaped curves T1 and T2 where the roller C2 can be smoothly moved while keeping a distance of a chain pitch Cp from the roller C1 and the roller C3, respectively.

Here, "the travel limiting position X1" in the present invention means a movement region where the roller C1 in the transmission chain C, pressed on the inner circumferential side of the chain with the travel limiting guide R including a linear track to travel at a fixed speed, travels on the travel limiting guide R, "the transfer position X2" means a movement region from the end of the travel limiting guide R to a position where the roller C2 in the transmission chain C sent from the travel limiting guide R approaches the sprocket S to mesh with it, and "the meshing position X3" means for example a movement region from a position where the roller C meshed with the sprocket S to a position where the roller was moved until a subsequent roller C meshes with the sprocket S.

Further, an arrangement level Hr of the travel limiting guide R may take any arrangement level, in which the transmission chain can reliably mesh with the sprocket S while being opened on the outer circumferential side of the chain from the travel limiting guide R during high speed traveling of the transmission chain C and the above-mentioned curve track T can form continuous two arc-shaped curves T1 and T2, that is an inner circumferential side of the chain than the tangential line (not shown) of a meshing pitch circle Sp formed in sprocket S.

Further, in FIG. 2, an inflection point Tp between two arc-shaped curves T1 and T2 can be defined as a traveling position of the roller C2 when the roller C1, which is traveling on the travel limiting position X1, the roller C2, which is traveling on the transfer position X2 and the roller C3, which is traveling on the meshing position X3, were brought into a linear arrangement state.

Therefore, the transfer guide for the high-speed power transmission of the present invention can be provided on at least an outer side or an inner side of a movement passage for the transfer position X2 based on a radius of curvature of the guide taking the two arc-shaped curves T1, T2 forming the above-mentioned movement passage and the roller radii of the rollers C1, C2, C3 into consideration.

That is the transfer guide 100 for the high-speed power transmission of the first Example shown in FIG. 1 comprises outer guides 111, 112 and inner guides 121, 122 provided along the movement passage taking the radii of the rollers at the transfer position X2 into consideration. Next, the transfer guide 200 for the high-speed power transmission of the second Example shown in FIG. 3 comprises outer guides 211, 212 and an inner guide 221 provided along the movement passage taking the radii of the rollers at the transfer position X2 into consideration. Next, the transfer guide 300 for the high-speed power transmission of the third Example shown in FIG. 4 comprises outer guides 311, 312 provided along the movement passage taking the radii of the rollers at the transfer position X2 into consideration. Also the transfer guide 400 for the high-speed power transmission of the fourth Example shown in FIG. 5 comprises an outer guide 411 and inner guide 421 provided on the side of the travel limiting guide R in the movement passage taking the radii of the rollers at the transfer position X2 into consideration, and the transfer guide 500 for the high-speed power transmission of the fifth Example shown in FIG. 6 comprises an outer guide 511 provided on the side of the travel limiting guide R in the movement passage taking the radii of the rollers at the transfer position X2 into consideration.

In the transfer guides 100, 200, 300, 400 and 500 for the high-speed power transmission of the present invention obtained as mentioned above, when continuous three rollers C1, C2, and C3 in the transmission chain are to be meshed with the sprocket S while being opened on the outer circumferential side of the chain from the travel limiting guide R toward the sprocket S, in arrangement traveling states, which are always corresponding to the transfer position X1, the transfer position X2 and the meshing position X2, a transfer position X2 just before the meshing with the driving sprocket S is defined along a movement passage consisting of continuous two arc-shaped curves T1 and T2 where the roller C2 can be smoothly moved while keeping a distance of a chain pitch Cp from the roller C1 and the roller C3, respectively. Accordingly, such a guide track T absorbs an change in the speed of the transmission chain C, which meshes with the sprocket S to perform a polygonal motion, so as to cancel the change, whereby the speed variation of the transmission chain C can be removed.

Therefore, according to the transfer guide for the high-speed power transmission of the present invention, even if the transmission chain C used as a timing chain for an automobile engine was traveled at high speed, a change in the speed of the transmission chain C, which meshes with the sprocket S to perform polygonal motion, is cancelled by the curve track T so that smooth transmission timing can be realized. Further, the durability of a chain power transmission mechanism can be ensured for a long period of time without the need of excessive driving power unlike conventional cases. Additionally, since a change in tension of the transmission chain C can be

removed, the miniaturization of the transmission chain C can be attained and transmission vibration and noise can be reduced. Thus, the effects of the present invention are very significant.

Effects of the Invention

According to the present invention, when three rollers in a transmission chain, which are continued at desired chain pitches and are traveled at a fixed speed by being pressed by a travel limiting guide including a linear track or a curve track in an inner circumferential side of the chain, are to be meshed with a sprocket, which is rotated at a fixed speed, while being opened on an outer circumferential side of the chain from the travel limiting guide, in such an arrangement traveling state that always corresponds to a travel limiting position, a transfer position and a meshing position, the curve track in the transfer guide for the high-speed power transmission is defined along a movement passage of the roller in the transfer position. Accordingly, even if the transmission chain is traveled at high speed, this curve track cancels a change in the speed of the transmission chain, which meshes with the sprocket to perform polygonal motion so that the speed variations of the transmission chain can be removed. Thus, the change in the transmission chain speed is canceled so that smooth transmission timing can be reliably realized and the driving power and vibration noise of the transmission chain can be significantly reduced.

Description of Reference Numerals

100, 200, 300, 400, 500... Transfer guide for a high-speed power transmission

111, 211, 311, 411, 511... Outer guide provided on a travel limiting guide R side

112, 212, 312 ... Outer guide provided on a sprocket S side

121, 221, 421 ... Inner guide provided on the travel limiting guide R side

122 ... Inner guide provided on the sprocket S side

S ... Sprocket

Sp ... Meshing pitch circle for the sprocket S

Sα ... Pitch angle for the sprocket S

C .. Transmission chain

C1 ... Roller traveling on the travel limiting guide R

C2 ...Roller sent from the travel limiting guide R

C3 ... Roller, which have been just meshed with the sprocket S

Cp ... Chain pitch

R ... Travel limiting guide

X1 ... Travel limiting position

X2 ... Transfer position

X3 ... Meshing position

T ... Guide track

T1, T2 ... Arc-shaped curve

Tp ... Inflection point between arc-shaped curves T1 and T2

Hr ... Arrangement level of the travel limiting guide R

The invention has been described herein by way of example only and those skilled in the art will readily recognize that changes may be made to the invention as described herein without departing from the spirit and scope of the claims which

follow hereinbelow.